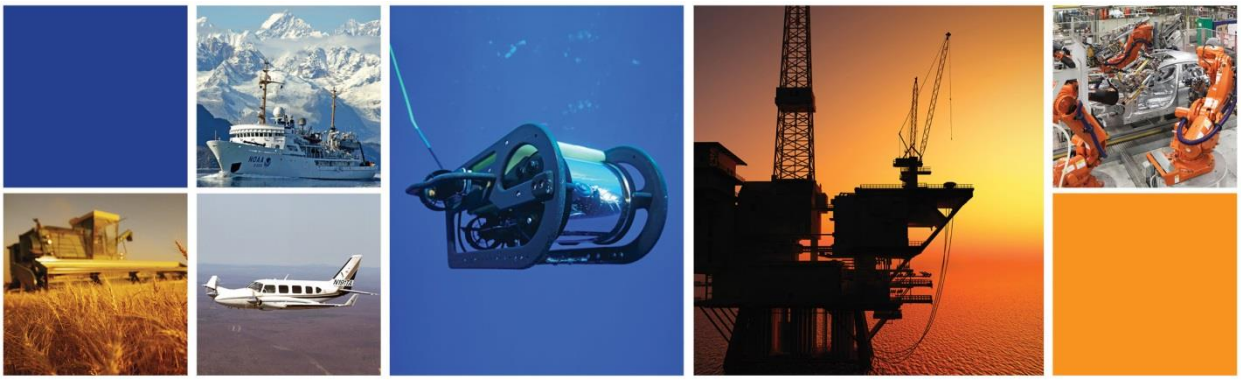
DMU30 Evaluation Kit
User Manual

DMU30-00-0100-910



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GLOSSARY

CD	Compact Disk
CD-ROM	CD-Read Only Memory
COM	Serial port interface
CSV	Comma Separated Variables
DMU	Dynamic Measurement Unit
FOG	Fibre Optic Gyroscope
FP	Floating Point
GND	Ground
IMU	Inertial Measurement Unit
kbit/s	kilobits per second
LPT	Parallel port interface
MB	Mega Bytes
ms	milliseconds
OEM	Original Equipment Manufacturer
PC	Personal Computer
PCB	Printed Circuit Board
RAM	Random Access Memory
RLG	Ring Laser Gyroscope
Rx	Receive
SP	Service Pack
Tx	Transmit
USB	Universal Serial Bus
Vel	Velocity

1 Introduction

DMU30 is the first of a new family of High Performance MEMS IMUs (HPIMU) incorporating precision VSG3QMAX high-Q inductive resonating ring gyroscopes and capacitive accelerometers. DMU30 represents a realistic, alternative to established FOG/RLG based IMUs due to its exceptional bias stability and low noise characteristics, yet it is comparatively compact, lightweight and offers low cost of ownership.

The DMU30 Evaluation Kit, see Figure 1, enables the output data from the DMU30 to be viewed and logged for testing and evaluating purposes.

This kit is primarily for use with the DMU30 build standard.

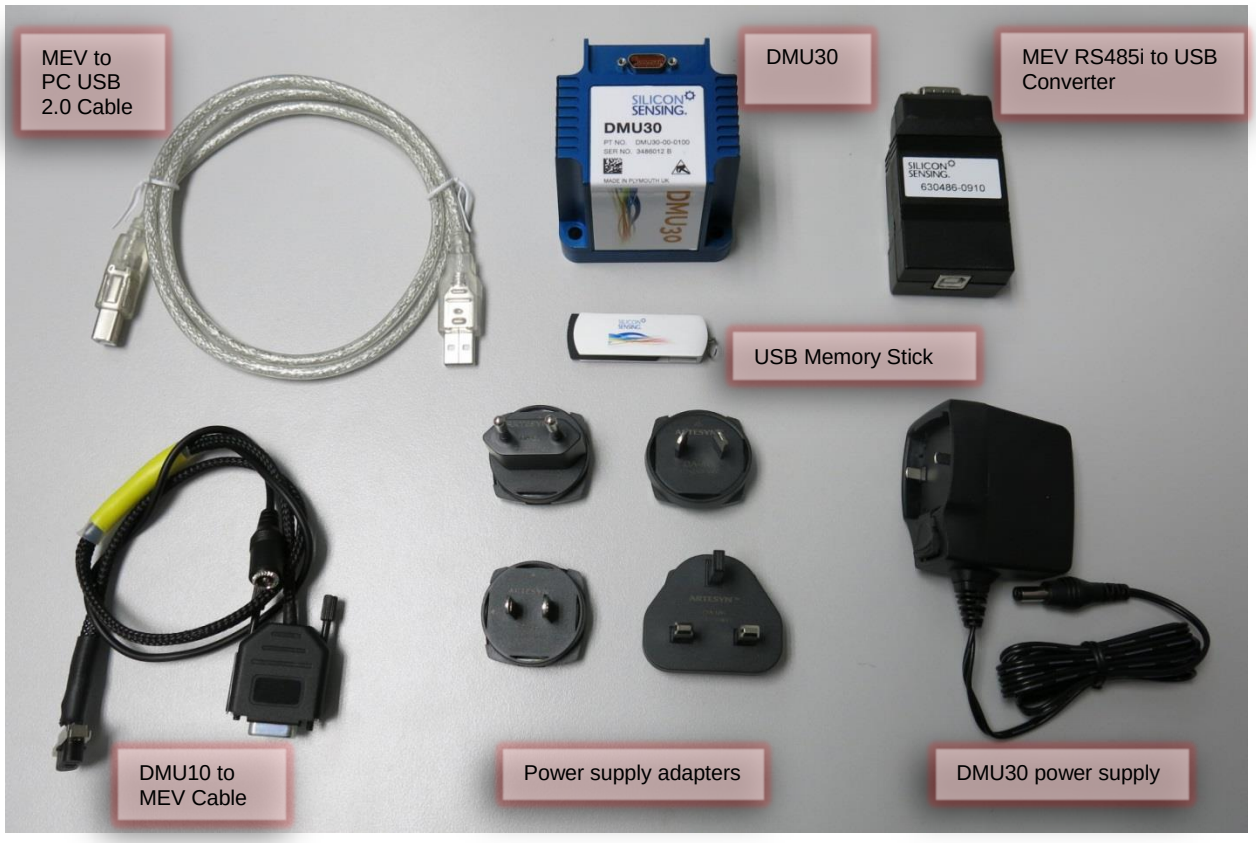


Figure 1: DMU30 Evaluation Kit

2 System Requirements

The DMU30 Evaluation Kit requires a PC with a USB port. The requirements for the PC are as follows:

- Microsoft® Windows® XP (SP3 or greater), Vista® or Window 7 and Windows 8 Operating Systems. The software has not been tested on any other operating systems and therefore correct functionality cannot be guaranteed.
- Minimum of 500 Mb of RAM.
- 500 Mb of free hard drive space plus space for logged data (typical data rate ≈ 50 kbit/s).
- High power or self-powered USB 2.0 Port.

3 Potential Restrictions and Issues

3.1 Performance issues

The USB interface on the PC can result in errors in the USB Message Stream introduced by interruptions by the operating system, resulting in possible loss of partial or complete messages. Such errors, if they occur, can be minimised by:

a) Minimising the number of other applications and software running on the PC.

b) Disconnecting the PC from a network or wireless connection.

c) Using very high speed PCs.

d) Disabling scheduled virus scans and Operating System updates.

e) Disabling all PC power saving options.

Any disruption to the message stream can be observed in the logged files using the message counter, checking for lost data.

3.2 MEV 485i Driver Settings

The MEV 485i driver is for the FTDI USB to serial hardware chip. This is in common use by USB to serial devices. The settings automatically applied by the DMU30 Utility (or manually by following the procedure described in section 5.4.6) are to allow this driver to perform correctly with the DMU Utility software. It is possible that these settings will not be suitable for other USB to serial devices that are using this driver.

If the PC used to run the DMU30 Utility software will be used for other applications that use this driver then it may be necessary to undo (or change) the settings described in section 5.4.6.

Note that the performance of the driver software may change between different versions of hardware and software for both the device and the PC. So experimentation with different settings may be required if the settings described in section 5.4.6 do not work.

4 Evaluation Kit Contents

The DMU30 evaluation kit (part number DMU30-21-0500) contains the following:

- DMU30 IMU (Part Number DMU30-21-0100)
- MEV RS485i to USB Converter, (Manufacturer Part Number USB485i)
- CD containing the MEV drivers
- USB memory stick (Part Number 630567-0920) containing the data logging software
- Interface Cables

4.1 DMU30

Figure 2 shows the Dynamic Measurement Unit used with the evaluation kit.

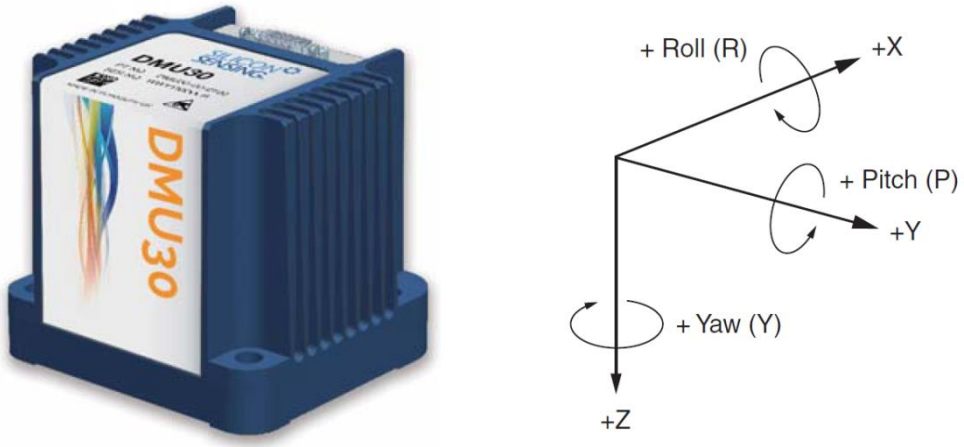


Figure 2: DMU30

4.2 MEV RS485i to USB Converter and CD

The RS485i to USB Converter is manufactured by MEV.

Figure 3: MEV RS485i to USB Converter

The drivers and user manual for the MEV are included on the MEV CD.

4.3 USB Memory Stick

The USB Memory Stick contains the following:

- Data Logging Software – 1-10695-020-430 Rev 1
- This User Manual
- DMU30 Brochure

4.4 Interface Cables

Two cables are included in the kit:

1. DMU30 to MEV Cable (Part Number 630567-0940)
2. MEV to PC USB 2.0 Cable.

5 Getting Started

5.1 Installation Overview

The software installation program uses the 'ClickOnce' installation format and can therefore be installed onto a PC without administrator rights. However, administrator rights are required whenever the application connects to an individual MEV device for the first time. This is because the application needs to change the MEV default driver settings, which are stored in the HKEY_LOCAL_MACHINE area of the Windows registry. For subsequent connections to that MEV device, the application will not require administrator rights. The recommended installation sequence is therefore:

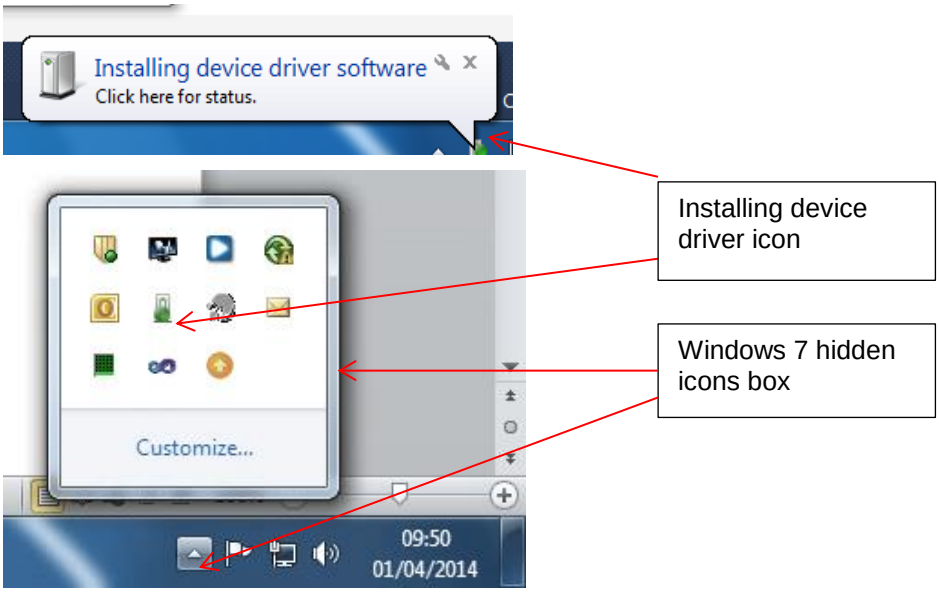
1. Obtain administrator rights on the PC.
2. Install the MEV driver, see section 5.2.
3. Install the software, see section 5.3.
4. The installation procedure automatically runs the application once the installation has completed and at this point you should connect to the installed MEV device using the **Connect** button.

5.2 Installing the MEV RS485i USB Serial Converter Device Driver

5.2.1 Installation Procedure

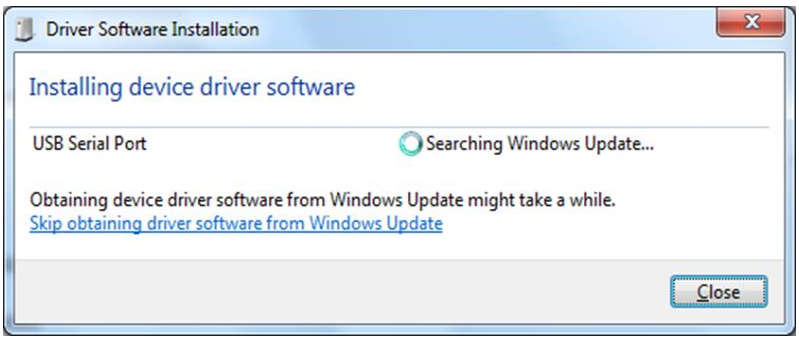
The MEV RS485i includes an installation CD containing a USB driver file. To install the driver, proceed as follows:

1. Ensure that you have administrator rights on the PC.
2. Run <CD ROM Drive letter>:\Drivers\Win XP, Vista, 7, 8, 2003-2012\CDM20828_Setup.exe. This will install the required drivers into the Windows System folder.
3. Plug the MEV RS485i device into a USB port and when the dialog below appears, be ready to click it or, if it disappears, click the animated icon that it is attached to. Note that in Windows 7, this icon can disappear into the hidden icon box when the dialog disappears.

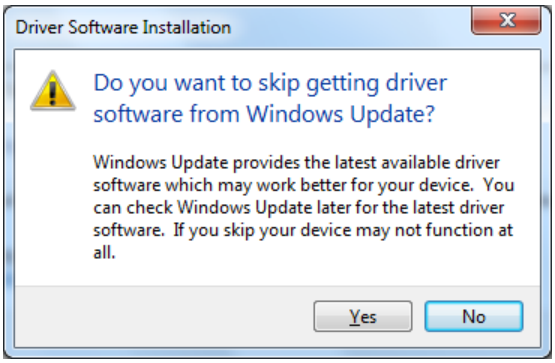


4. When the dialog shown below appears, click **Skip obtaining driver software from Windows Update**.

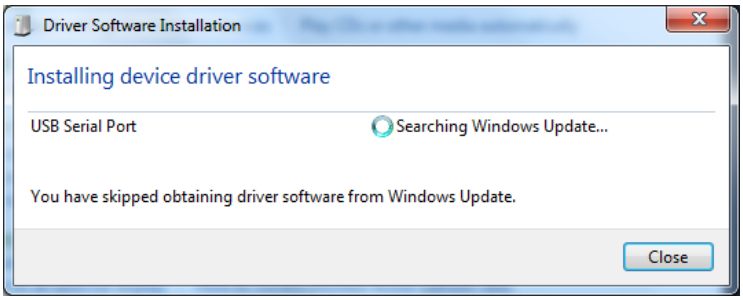
If the PC has an internet connection, you can wait for the latest driver to be found via Windows Update. In which case, you can skip to step 7 of this procedure. Note however that if a newer driver version is loaded, the software may not have been tested with this driver version.



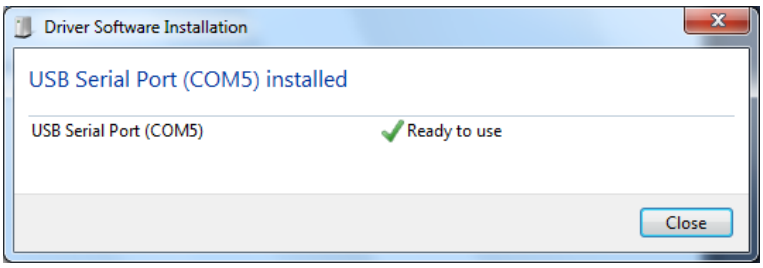
5. Click **Yes** when the following dialog appears:



6. The following dialog should then appear and you must wait (do not click **Close** because the installation program has not completed yet):



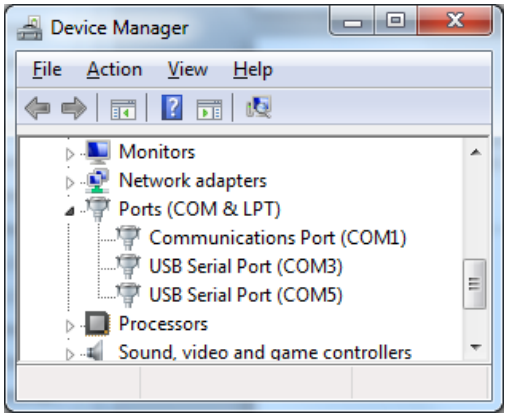
7. The installation program should then locate the previously installed drivers and you should eventually see the following dialog:



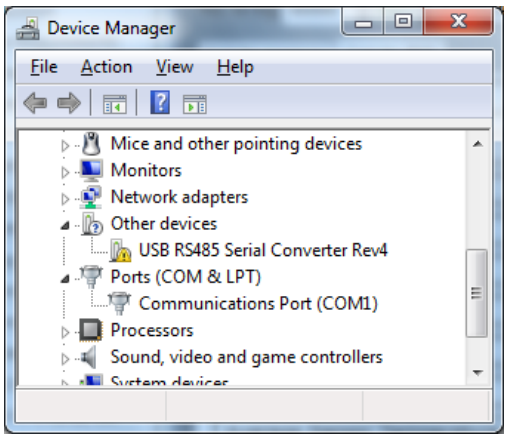
8. Click **Close** on the above dialog.

5.2.2 MEV Installation Troubleshooting

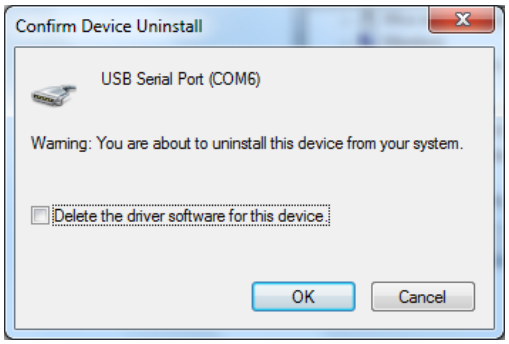
Correctly installed MEV devices should appear in the Windows Device Manager as USB virtual COM ports. These devices will disappear when the USB cable is removed but should re-appear when it is re-inserted. These same COM ports will appear in the DMU30 Utility serial port drop down list, enabling the application to connect to different MEV devices.



Note that each MEV device appears as a separate COM port and you will need to repeat steps 3 to 8 of the installation procedure for each MEV device plugged into the PC. If a MEV device appears under the **Other devices** heading of **Device Manager** instead of the **Ports (COM & LPT)** heading, then the device is in the process of being installed and you should not unplug it (look for the **Installing Driver** icon in the lower icon bar and follow steps 3 to 8 of the installation procedure).



If you encounter problems connecting to a MEV device using the application's **Connect** button, it is possible that the installation failed. You can repeat an installation by right clicking on the device under the **Ports (COM & LPT)** heading and selecting the **Uninstall** option. When the dialog below appears, click **OK**. You must then unplug the USB cable and then plug it back in to restart the installation procedure (steps 3 to 8) again.



If the MEV is not detected when the USB cable is plugged into the PC, refer to the MEV USB232/485 Instruction Manual included on the CD within the DMU30 Evaluation Kit. Additional information may be also available on the MEV website at http://www.mev.co.uk

5.3 Installing the Data Logging Software

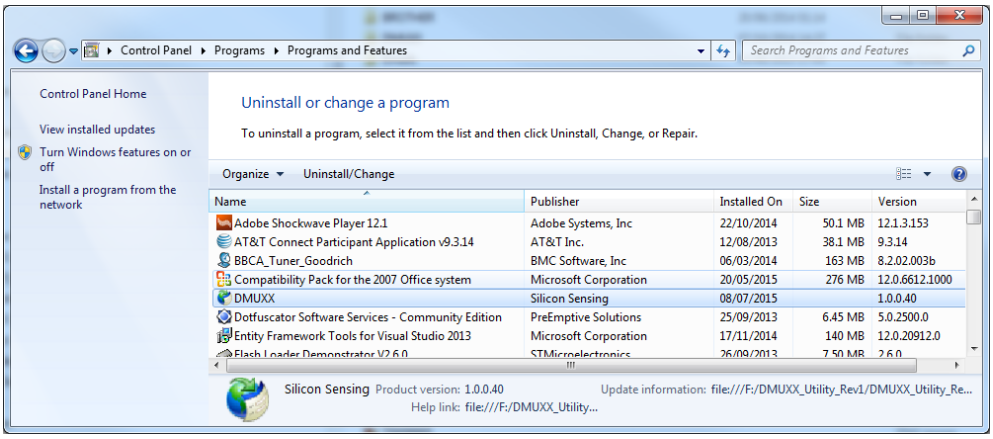
The data logging software is included on the USB Memory Stick within the DMU30 Evaluation Kit.

This software should work on all supported versions of Windows including XP.

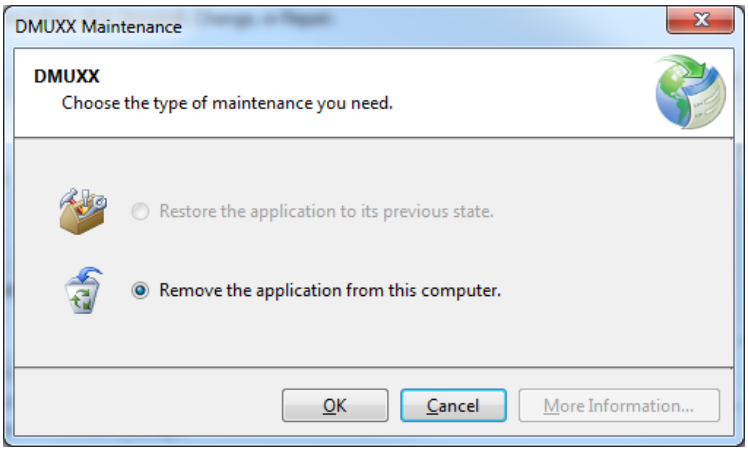
5.3.1 Installation Procedure

To install the software, proceed as follows:

1. If a previous version of the Utility has been installed on the PC, you should un-install it first to prevent two different versions appearing. To do this select **Control Panel | Programs | Uninstall a program** to open the **Uninstall or change a program** dialog. Left click on the DMU30 program and select **Uninstall/Change**.

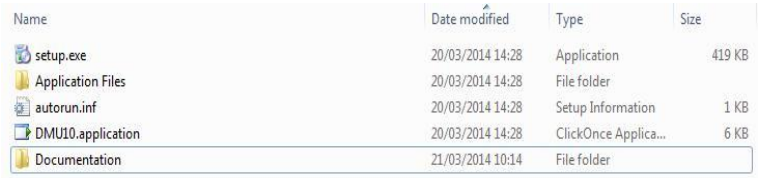


2. Click **OK** to remove the application from the PC.



3. If you have not already installed the MEV device driver, you should do this now (see section 5.2), and then ensure that the MEV device is plugged into a USB port on the PC.

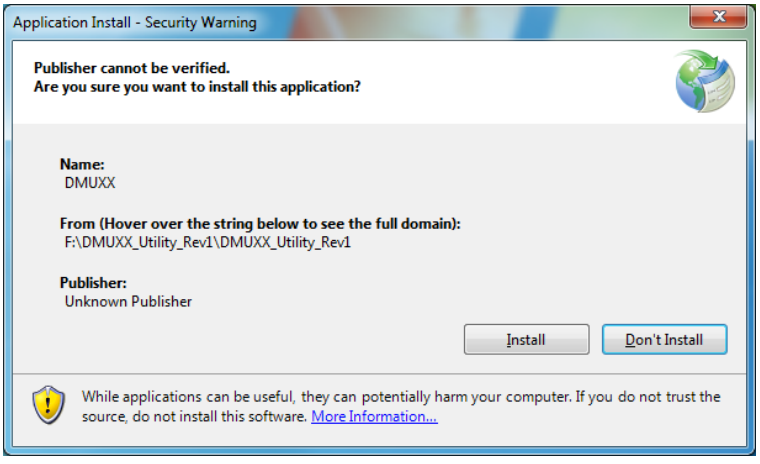
4. Insert the USB Memory Stick into a USB Port on your PC. Once the memory stick is detected, you should see the following files:



5. Run the Setup.exe program.

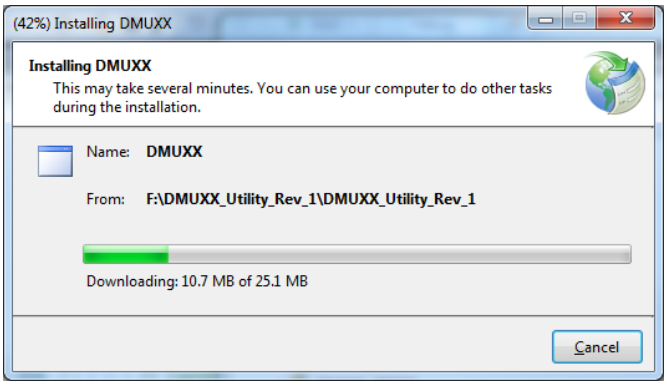
   Depending on how administrator rights are managed on some installations, you may need to select Setup.exe in its folder (it must be highlighted) and then right click and select the **Run as administrator** option in order to ensure that the installation is run with administrator rights.

   You may see the following message displayed because the software is proprietary to Silicon Sensing Systems Ltd and has not been registered with Microsoft.



6. Click **Install** to install the data logging software.

7. The installation should then proceed with the following dialog:



The software will install at the following location:

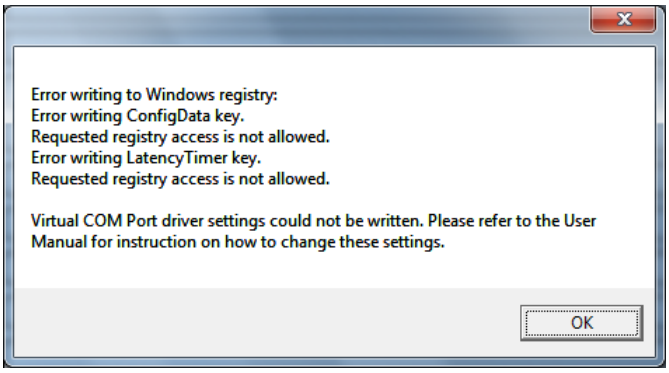
Start | All Programs | Silicon Sensing

8. When the installation has completed, the application will be started by the install program. You should then ensure that a USB Serial Port is selected and then click the **Connect** button. This will write the required MEV driver settings to the Windows Registry. If you intend to use other MEV devices and do not normally have administrator rights on the PC, you should plug all the MEV devices into the PC now and repeat the connection process to ensure that each device has the correct settings written to the Windows Registry file.

   The software installation process is now complete.

5.3.2 Installation Troubleshooting

If the installation program was run without administrator rights, the application will be unable to write the required settings to the registry when the **Connect** button is pressed and the dialog below will appear. If this occurs, you should first attempt to uninstall the application and then re-install it (with administrator rights). If you are unable, for any reason, to install the application with administrator rights, then the settings must be changed manually by following the procedure in section 5.4.6. Note however that changing these settings will also require administrator rights.



5.4 Using the Software

5.4.1 Starting the Application

Go to **Start** | **All Programs | Silicon Sensing** and select **DMUXX** to launch the application.

Note: In Windows 8, the installation will create a DMU30 icon in the **Start** menu.

To use the application, the interface cables described in section 4.4 must be used to connect together the PC, MEV and DMU30.

5.4.2 Main Window

The application's main window is shown in Figure 4.

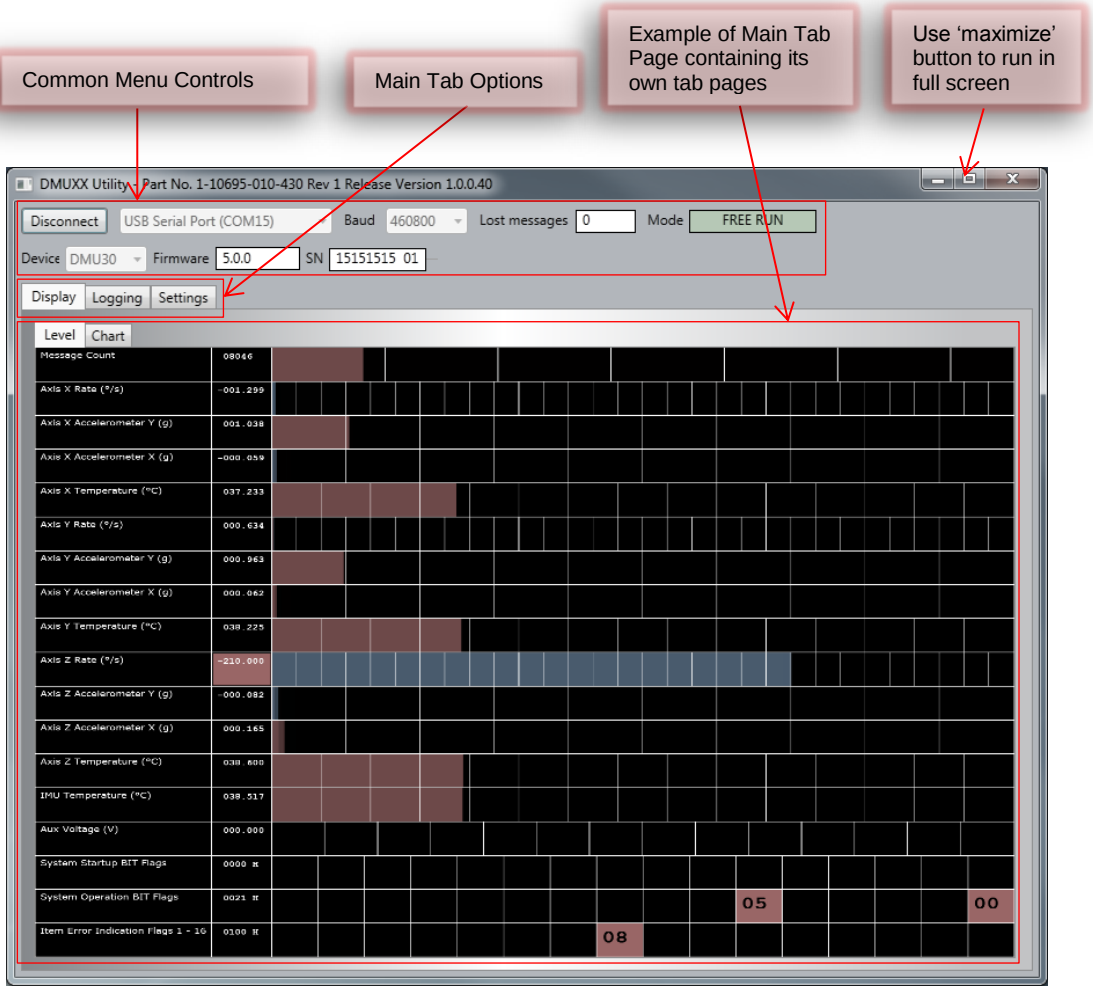


Figure 4: Software Application Main Window

5.4.2.1 Common Controls

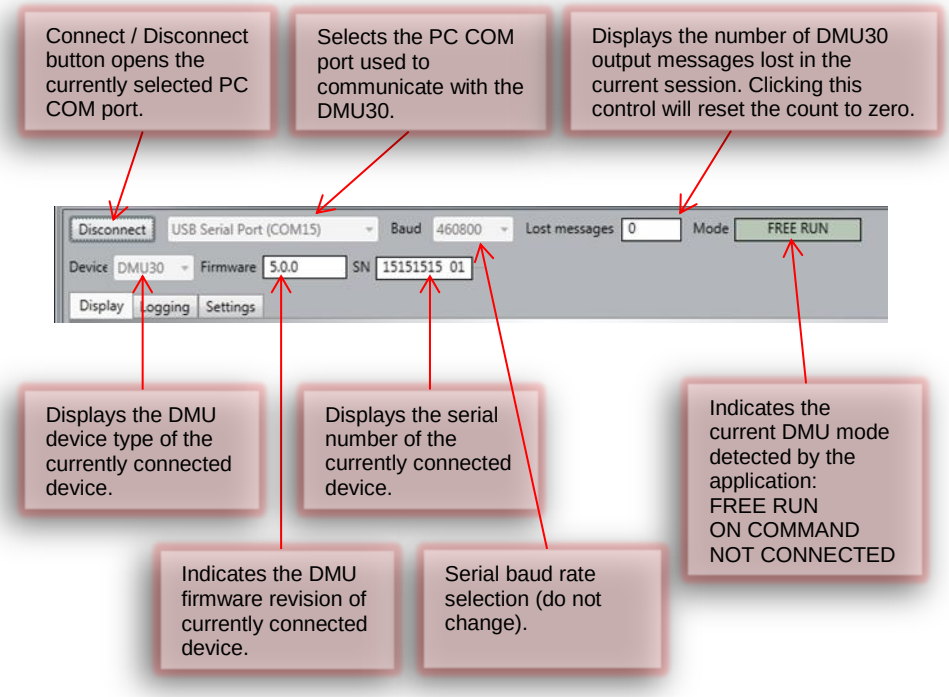


Figure 5: Main Controls

Common controls always remain visible and are used by all Tab pages. These controls have tool tips (help text will appear when you hover the mouse cursor over an enabled control).

5.4.2.2 Main Tab Options

There are three main tab options:

- Display
- Logging
- Settings

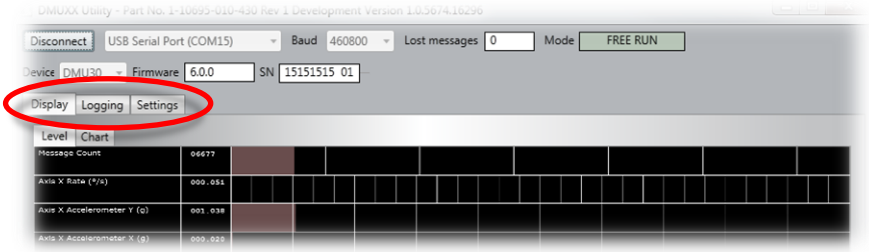


Figure 6: Main Tab Options

The following sections describe each tab in detail.

5.4.3 Display Tab

The **Display** tab displays the DMU30 output data in real-time using level meters and a chart recorder.

The “Connect / Disconnect” button must be pressed to connect the DMU30 in order to display DMU30 data output.

5.4.3.1 Level Meters Display

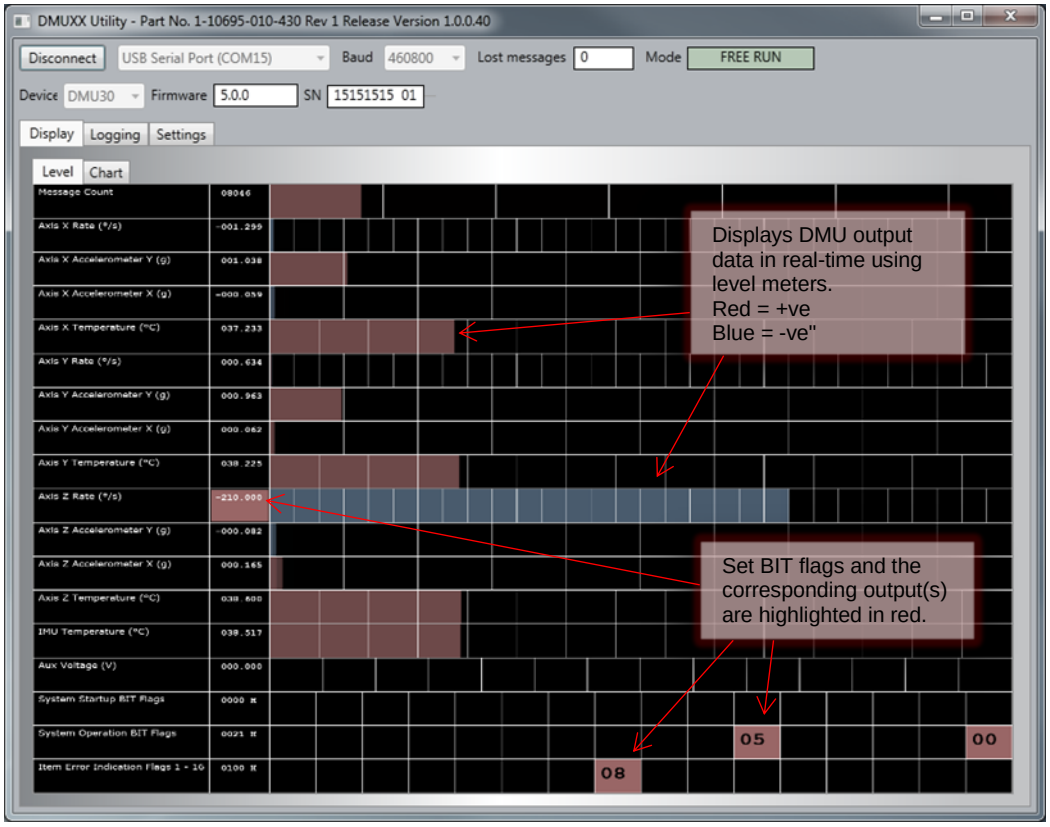


Figure 7: Real-time Display Page

Built In Test (BIT) flags (“System Startup” and “System Operation”) are related to specific sensor outputs using the “Item Error Indication” flags.

So, for example, in the image above, System Operation bit 05 (over range) is set. Item Error Indication bit 08 is also set and indicates that sensor value “Axis Z Rate” is the value that the over range flag applies to.

For convenience, the application highlights the sensor value that corresponds to the raised BIT flag. Note that offset counting begins at the first sensor output (Axis X Rate) and not at “Message Count” (which is not a sensor output and will therefore not have BIT flags associated with it).

5.4.3.2 Chart Recorder

The chart recorder displays and records DMU output data. Data can be saved and loaded in CSV format.

The chart recorder will only appear once the “Connect” button has been pressed to connect the application to the DMU.

Sampling can be started and stopped using the “Start Sampling” button.

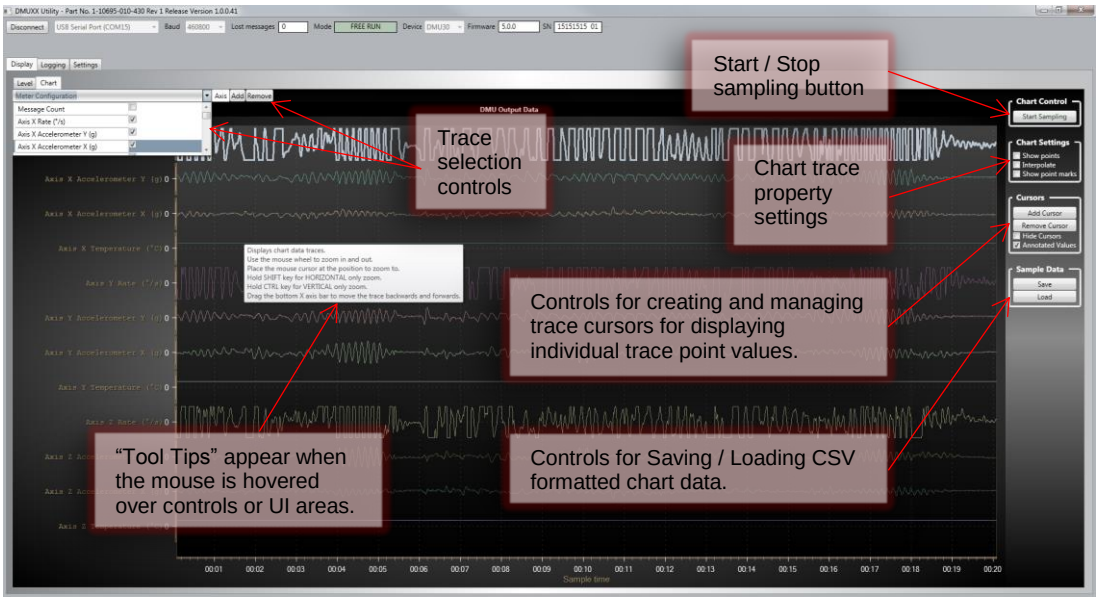
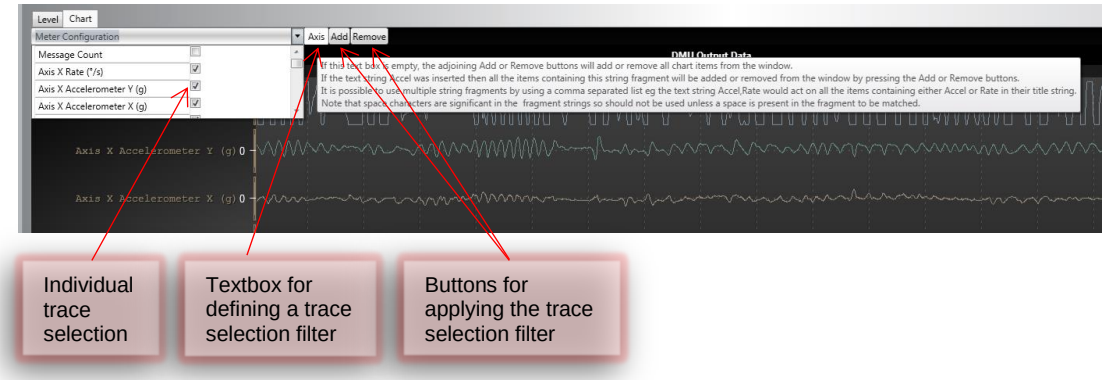


Figure 8 Chart Recorder Overview

5.4.3.2.1 Trace Selection Controls



Traces can either be selected individually, using the drop down selection control or by entering a trace title filter string into the text box and using the Add and Remove buttons.

An empty filter string box will select all of the traces.

A filter string of “Axis” will select all traces with “Axis” in the title.

The filter allows for multiple strings to be added using a “,” (comma) separator. So for example “Accel,Rate” would select all the traces containing either “Accel” or “Rate” in their title.

Note that spaces are significant in the string fragments.

5.4.3.2.2 Data Analysis Functions

It is possible to zoom into areas of the data and view individual sample values. Any number of cursors can be added and dragged over the data series, displaying each trace value.

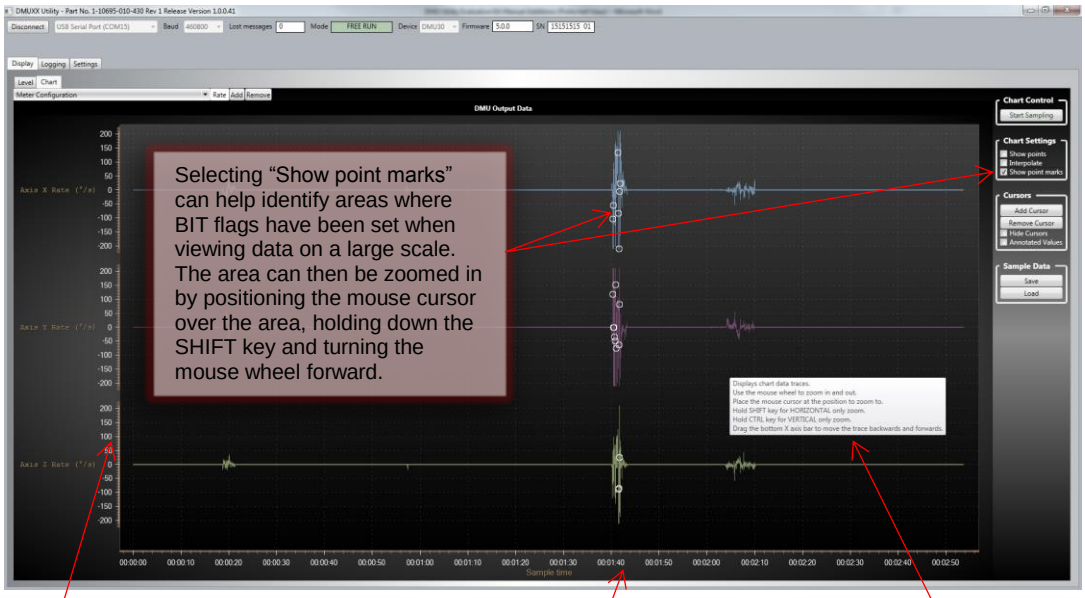
5.4.3.2.2.1 Zooming and panning sample data

Note that the zooming function uses the mouse wheel and so a mouse with a mouse-wheel is required (the “wheel” simulation on a lap-top track pad may not be suitable).

For zooming in and out:

- Rotate the mouse wheel to zoom in and out.
- Hold down the SHIFT key for X only zoom (after positioning the cursor at the point to zoom into)
- Hold down the CTRL key for Y only zoom (magnifies the Y scale for all traces).

For panning in the X direction, drag the X axis bar at the bottom of the window.



5.4.3.2.2.2 Marking of sample points with corresponding BIT flags

Built In Test (BIT) flags (“System Startup” and “System Operation”) are related to specific sensor outputs using the “Item Error Indication” flags. So, for example, if bit 0 of the “Error Indication Flags” is set, this indicates that BIT flags relating to the first sensor output value in the list (“Axis X Rate”) have been set. In this way it is therefore possible to identify which individual sample values have BIT flags associated with them.

For convenience, sample values with associated BIT flags can be marked (using a white circle) by selecting “Show point marks”.

Figure 9 Marking sample points with associated BIT errors

5.4.3.2.2.3 Using cursors to view sample data values

- Any number of cursors can be added.
- Cursors will always be added to the start of sampling, so it may be necessary to zoom out to access a newly added cursor. Zooming out will also provide an overview of all the current cursors.
- Cursors can also be used to mark an area of interest.
- The “Remove cursor” button will remove the last added cursor.
- Selecting “Annotated” cursors will display sample data inside a box with trace title annotations against the data values. Otherwise the data values will be displayed at the far right of the window.

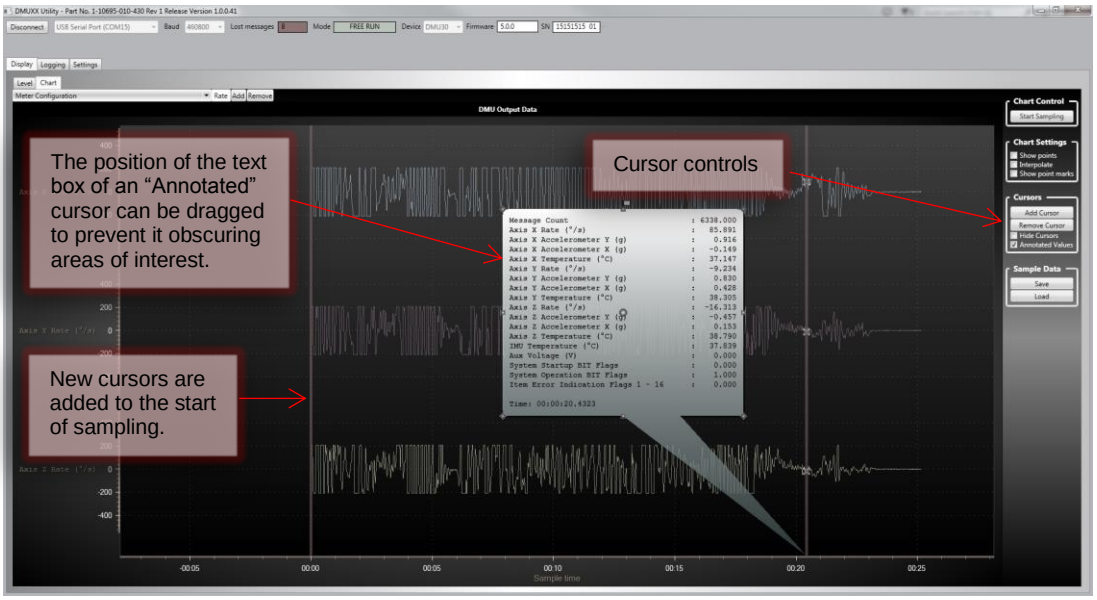


Figure 10 Using Cursors

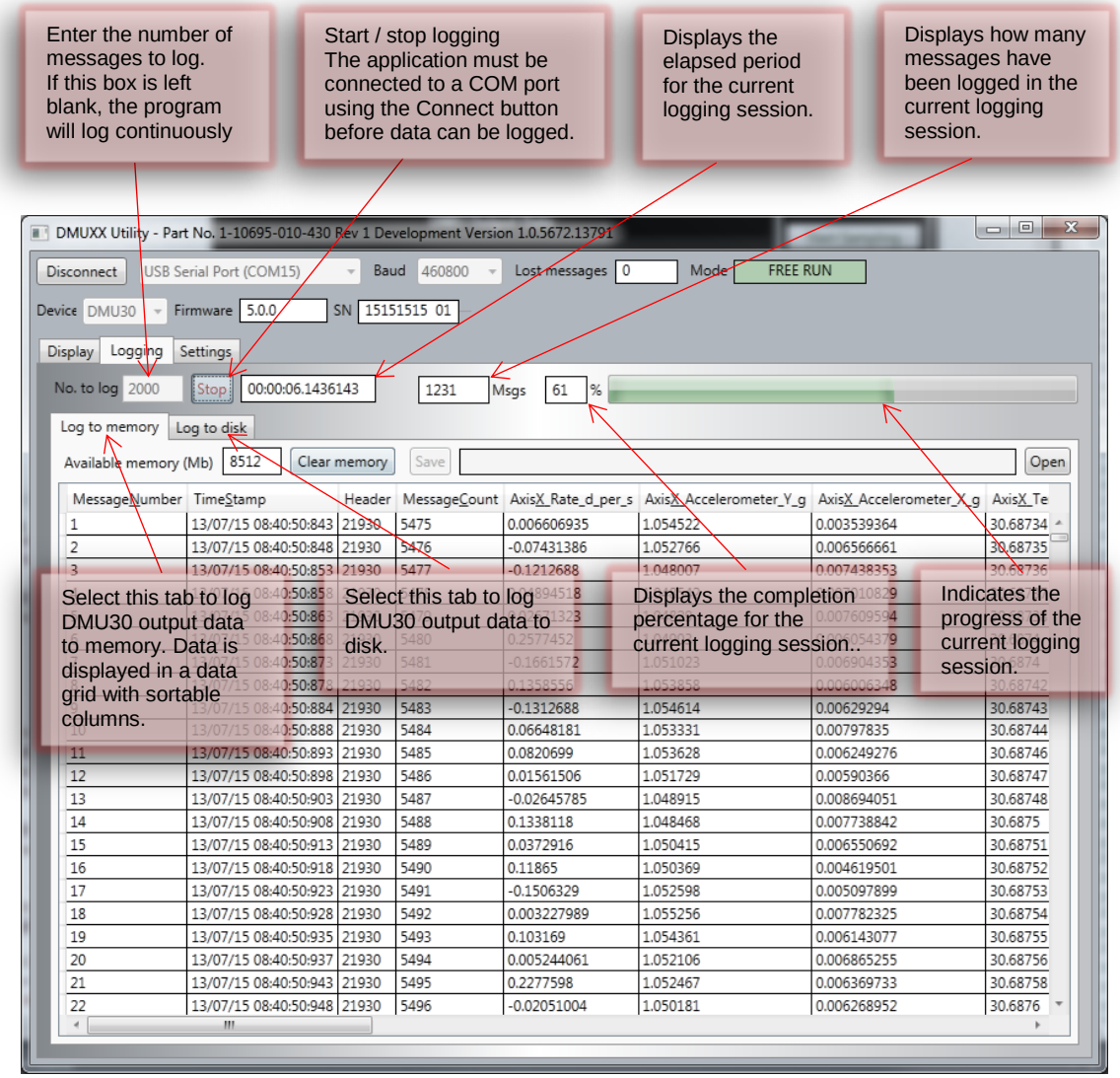
5.4.4 Logging Tab

The **Logging** tab enables the DMU data output to be logged for evaluation purposes.

For data logging, you must first connect the application to a MEV USB Serial Port as described in section 5.4.2.1.

The Logging tab contains two tabs:

- Log to memory
- Log to disk



MessageNumber	TimeStamp	Header	MessageCount	AxisX_Rate_d_per_s	AxisX_Accelerometer_Y_g	AxisX_Accelerometer_X_g	AxisX_Te
1	13/07/15 08:40:50:843	21930	5475	0.006606935	1.054522	0.003539364	30.68734
2	13/07/15 08:40:50:848	21930	5476	-0.07431386	1.052766	0.006566661	30.68735
3	13/07/15 08:40:50:853	21930	5477	-0.1212688	1.048007	0.007438353	30.68736
11	13/07/15 08:40:50:893	21930	5485	0.0820699	1.053628	0.006249276	30.68746
12	13/07/15 08:40:50:898	21930	5486	0.01561506	1.051729	0.00590366	30.68747
13	13/07/15 08:40:50:903	21930	5487	-0.02645785	1.048915	0.008694051	30.68748
14	13/07/15 08:40:50:908	21930	5488	0.1338118	1.048468	0.007738842	30.6875
15	13/07/15 08:40:50:913	21930	5489	0.0372916	1.050415	0.006550692	30.68751
16	13/07/15 08:40:50:918	21930	5490	0.11865	1.050369	0.004619501	30.68752
17	13/07/15 08:40:50:923	21930	5491	-0.1506329	1.052598	0.005097899	30.68753
18	13/07/15 08:40:50:928	21930	5492	0.003227989	1.055256	0.007782325	30.68754
19	13/07/15 08:40:50:935	21930	5493	0.103169	1.054361	0.006143077	30.68755
20	13/07/15 08:40:50:937	21930	5494	0.005244061	1.052106	0.006865255	30.68756
21	13/07/15 08:40:50:943	21930	5495	0.2277598	1.052467	0.006369733	30.68758
22	13/07/15 08:40:50:948	21930	5496	-0.02051004	1.050181	0.006268952	30.6876

Figure 11: Logging Tab Overview

5.4.4.1 Log File Format

The data is logged in a CSV format. This can be imported into an Excel spreadsheet or read using MATLAB® or other similar analysis tools. Table 1 shows the contents of the message stream sent from the DMU Evaluation Kit to the PC. When the File is imported into MS Excel, the Worksheet is formatted in Columns in accordance with Table 3. The message rate is 200 Hz, therefore the time between each message is 5 ms.

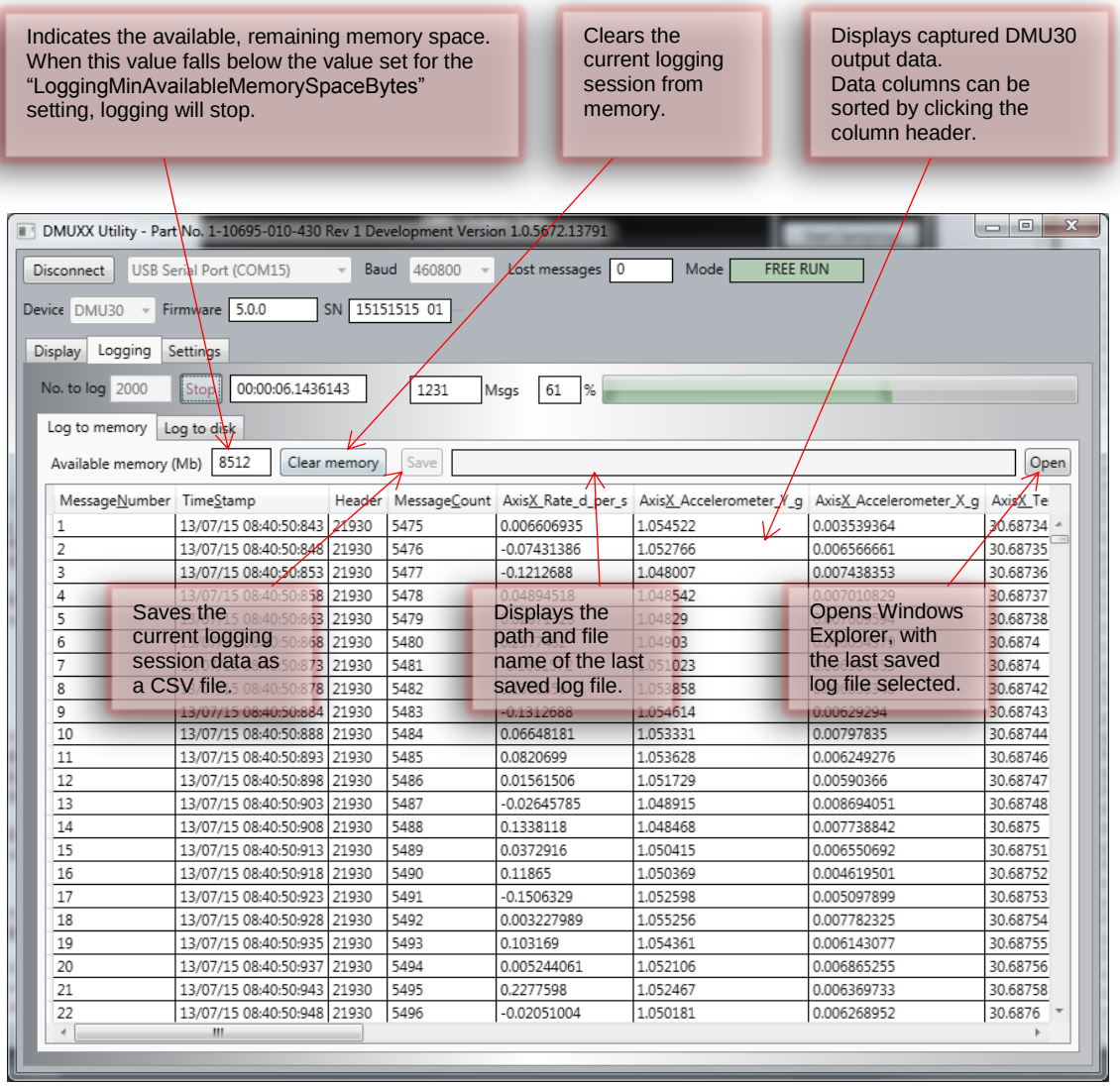
Col	Data Item	Value / Units
A	Message	Message Number.
B	Time Stamp	Date and Time.
C	Header	0x55AA
D	Message Count	16 Bit, 0 to 65535 decimal, overflowing.
E	Axis X Rate	32 Bit Single Precision FP, (˚/s).
F	Axis X Acceleration	32 Bit Single Precision FP, (g).
G	Axis Y Rate	32 Bit Single Precision FP, (˚/s).
H	Axis Y Acceleration	32 Bit Single Precision FP, (g).
I	Axis Z Rate	32 Bit Single Precision FP, (˚/s).
J	Axis Z Acceleration	32 Bit Single Precision FP, (g).
K	Aux Input Voltage	32 Bit Single Precision FP, (volts).
L	Average IMU Temperature	32 Bit Single Precision FP, (˚C).
M	Axis X Delta Theta	32 Bit Single Precision FP, (˚).
N	Axis X Delta Vel	32 Bit Single Precision FP, (m/s).
O	Axis Y Delta Theta	32 Bit Single Precision FP, (˚).
P	Axis Y Delta Vel	32 Bit Single Precision FP, (m/s).
Q	Axis Z Delta Theta	32 Bit Single Precision FP, (˚).
R	Axis Z Delta Vel	32 Bit Single Precision FP, (m/s).
S	Axis X BIT Data	0 to 65535 decimal.
T	Axis Y BIT Data	0 to 65535 decimal.
U	Axis Z BIT Data	0 to 65535 decimal.
V	Checksum	16 Bit 2’s Complement of the 16 Bit Sum of the Previous 0-18 data items.

Table 1: Operational Message Data Output Descriptions

5.4.4.2 Log to memory

This option should be used for short logging sessions where it is useful to view the data on-screen. Logged data can also be saved to disk in CSV format.

The **LoggingMinAvailableMemorySpaceBytes** setting (see Table 2) enables the user to control the remaining memory space limit.



MessageNumber	TimeStamp	Header	MessageCount	AxisX_Rate_d_per_s	AxisX_Accelerometer_Y_g	AxisX_Accelerometer_X_g	AxisX_Te
1	13/07/15 08:40:50:843	21930	5475	0.006606935	1.054522	0.003539364	30.68734
2	13/07/15 08:40:50:848	21930	5476	-0.07431386	1.052766	0.006566661	30.68735
3	13/07/15 08:40:50:853	21930	5477	-0.1212688	1.048007	0.007438353	30.68736
4	13/07/15 08:40:50:858	21930	5478	0.04894518	1.048542	0.007010829	30.68737
5	13/07/15 08:40:50:863	21930	5479	-0.1312688	1.04829	0.00629294	30.68738
6	13/07/15 08:40:50:868	21930	5480	0.06648181	1.04903	0.00797835	30.6874
7	13/07/15 08:40:50:873	21930	5481	0.0820699	1.051023	0.006249276	30.6874
8	13/07/15 08:40:50:878	21930	5482	0.01561506	1.053858	0.00590366	30.68742
9	13/07/15 08:40:50:884	21930	5483	-0.1312688	1.054614	0.00629294	30.68743
10	13/07/15 08:40:50:888	21930	5484	0.06648181	1.053331	0.00797835	30.68744
11	13/07/15 08:40:50:893	21930	5485	0.0820699	1.053628	0.006249276	30.68746
12	13/07/15 08:40:50:898	21930	5486	0.01561506	1.051729	0.00590366	30.68747
13	13/07/15 08:40:50:903	21930	5487	-0.02645785	1.048915	0.008694051	30.68748
14	13/07/15 08:40:50:908	21930	5488	0.1338118	1.048468	0.007738842	30.6875
15	13/07/15 08:40:50:913	21930	5489	0.0372916	1.050415	0.006550692	30.68751
16	13/07/15 08:40:50:918	21930	5490	0.11865	1.050369	0.004619501	30.68752
17	13/07/15 08:40:50:923	21930	5491	-0.1506329	1.052598	0.005097899	30.68753
18	13/07/15 08:40:50:928	21930	5492	0.003227989	1.055256	0.007782325	30.68754
19	13/07/15 08:40:50:935	21930	5493	0.103169	1.054361	0.006143077	30.68755
20	13/07/15 08:40:50:937	21930	5494	0.005244061	1.052106	0.006865255	30.68756
21	13/07/15 08:40:50:943	21930	5495	0.2277598	1.052467	0.006369733	30.68758
22	13/07/15 08:40:50:948	21930	5496	-0.02051004	1.050181	0.006268952	30.6876

Figure 12: Log to memory Tab

5.4.4.3 Log to Disk

This option should be used for logging large amounts of data.

Log files are created automatically, using a sort friendly date-time file name format.

Year, month, day, hour, minute, second, millisecond, DMU type, Firmware Number, Serial Number

Eg: _2015_07_13_09_33_13_DMU30_FW5_0_0_SN1515151501

The location that log files are stored in can be set by clicking the log file location display box or by editing the **LoggingLogFileDirectory** setting (section 5.4.5). If the **LoggingLogFileDirectory** setting is left empty, a default location will be used.

The size that a log file is allowed to grow to is set by the **LoggingRecordsPerLogFile** setting (section 5.4.5). When this size is reached, a new log file is created.

The **LoggingMinAvailableDriveSpaceBytes** setting (section 5.4.5) allows the user to control the remaining drive space limit.

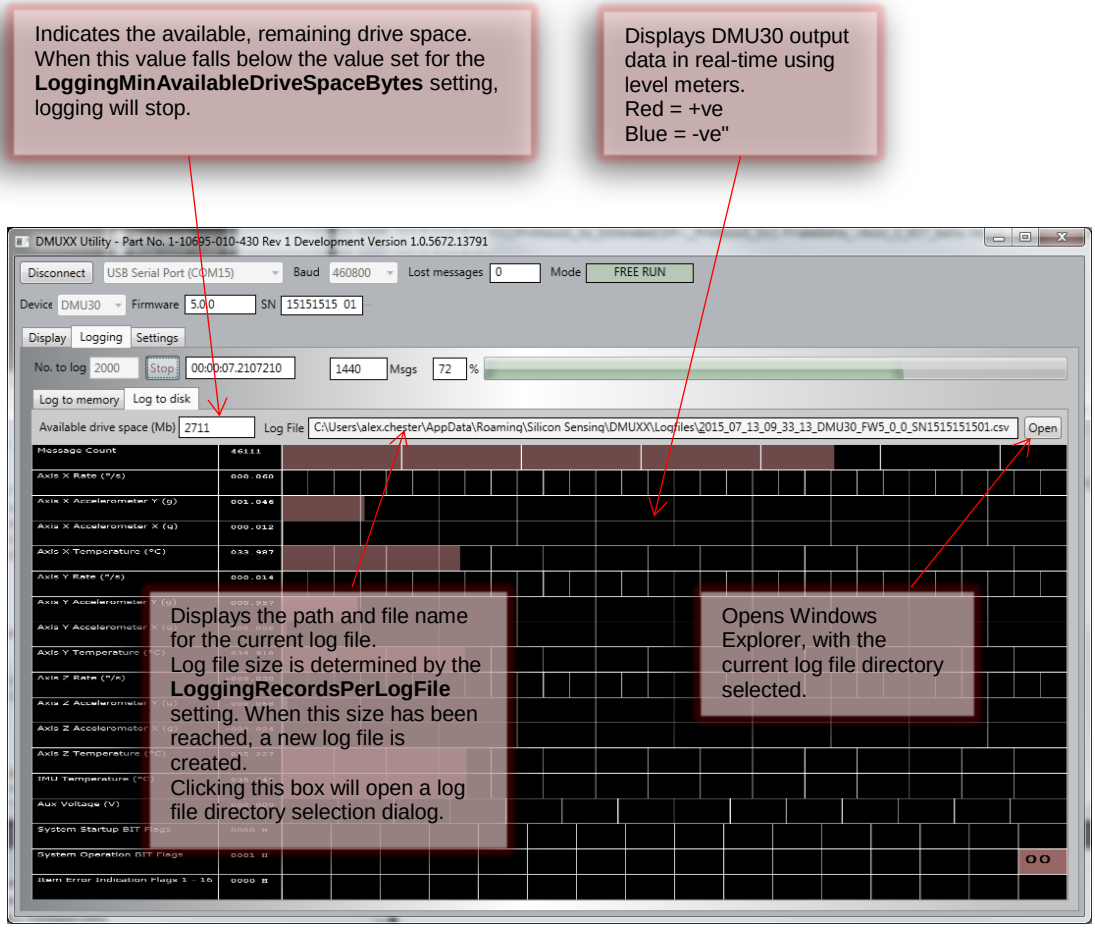


Figure 13: Log to disk Tab

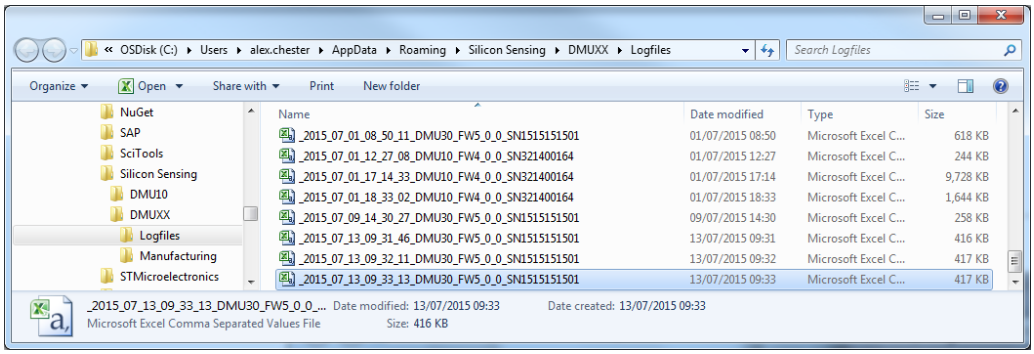


Figure 14: Log files in the default log file directory

5.4.5 Settings Tab

The **Settings** tab displays application user settings for editing. If you require a setting to become permanent (i.e. persist between DMU30 Utility re-starts) click **Save settings**.

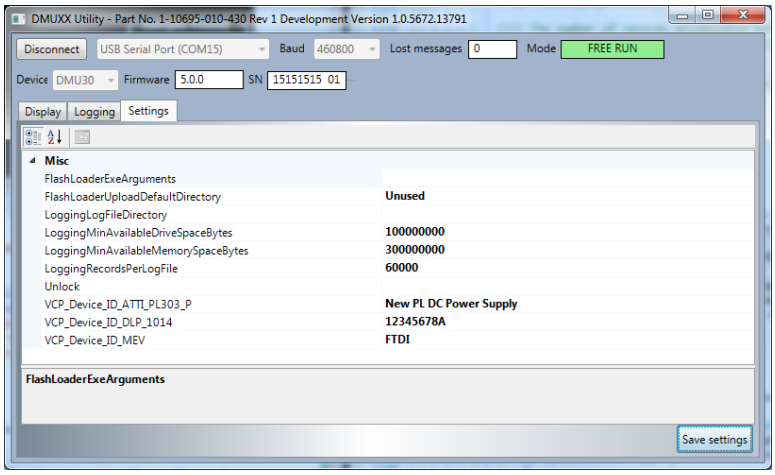


Figure 15: Settings Page

5.4.5.1 Default Settings

The following default application settings are used.

Setting name and description	Default value
FlashLoaderUploadDefaultDirectory This setting should be left empty	
LoggingLogFileDirectory Overrides the default location for storing log files. This can be edited here or set from the "Log to Disk" page using a selection dialog. Leave this setting empty if you want the default location to be used.	
LoggingMinAvailableDriveSpaceBytes When logging data to disk, logging will stop when the remaining drive space (in bytes) drops to this limit.	100000000
LoggingMinAvailableMemorySpaceBytes When logging data to memory, logging will stop when the remaining memory space (in bytes) drops to this limit.	300000000
LoggingRecordsPerLogFile When the number of records in a log file reaches this limit, a new log file is created. The DMU30 outputs data at 200Hz so the default setting of 60000 will result in a new file every 5 minutes that is approximately 12.5 Mb in size.	60000
Unlock This setting should be left empty.	Empty

Table 2: Default Settings

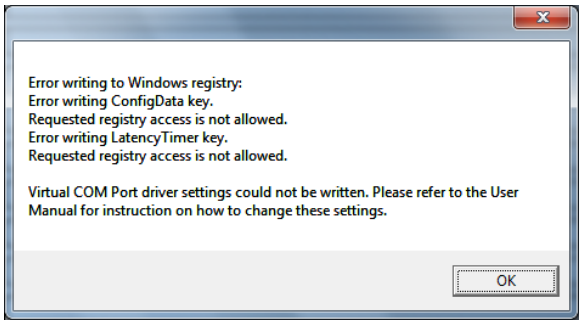
Please do not attempt to change any parameters not listed in Table 2. Changes may result in non-functioning software.

5.4.6 Changing the MEV 485i Driver Settings

To perform correctly the DMU30 utility software requires non-default MEV 485i driver settings.

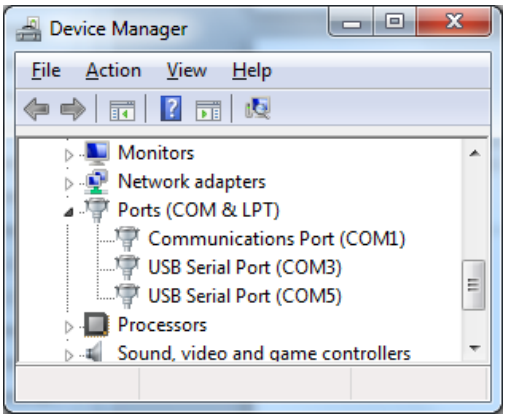
The software will attempt to change them if it detects that they are incorrect.

If the software cannot change these settings, it will inform the user by displaying a message.

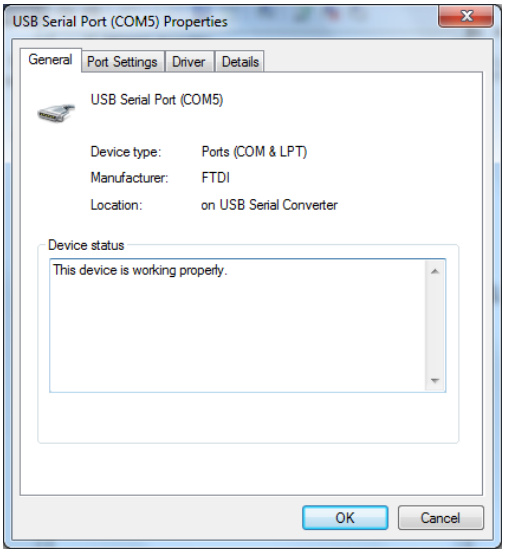


If a message like this appears, follow the procedure below to change the settings:

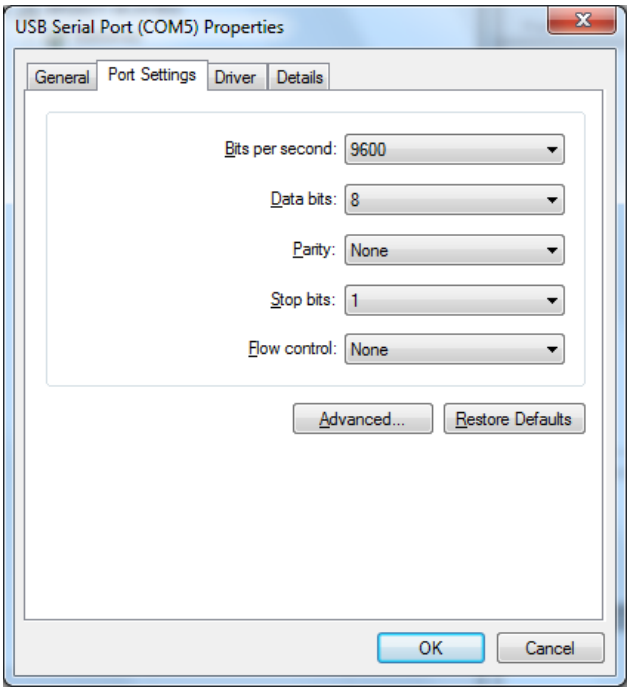
1. Open **Windows Device Manager**. Instructions for doing this vary between operating systems. In Windows 7, this can be accessed using Start / Control Panel / Hardware and Sound / Device Manager.
2. Open **Ports (COM & LPT)**



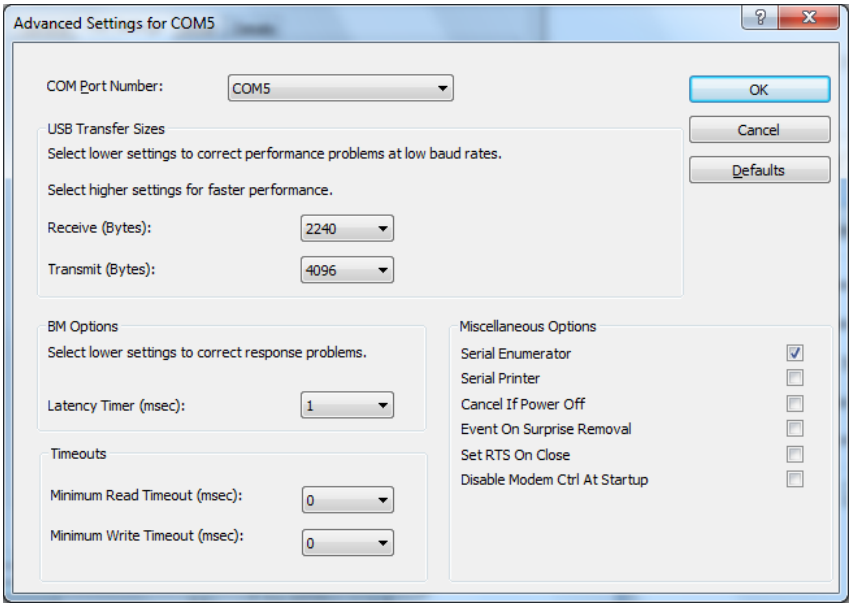
3. Double click the port that requires changing (the COM port that the DMU30 Utility will connect to)



4. Select the **Port Settings** tab.



5. Click **Advanced**. If this results in a message informing you that you do not have write privilages for the registry then you must obtain Administrator rights before continuing with this procedure. Otherwise, change the **Receive (Bytes)** value to 2240 and the **Latency Timer (msec)** value to 1 (as shown below).



6. Click **OK** to save these settings.

6 Using the DMU30 without the Evaluation Kit

The information in this section is provided to enable the user to use the DMU30 with alternative logging equipment.

Figure 13 shows the internal architecture for DMU30.

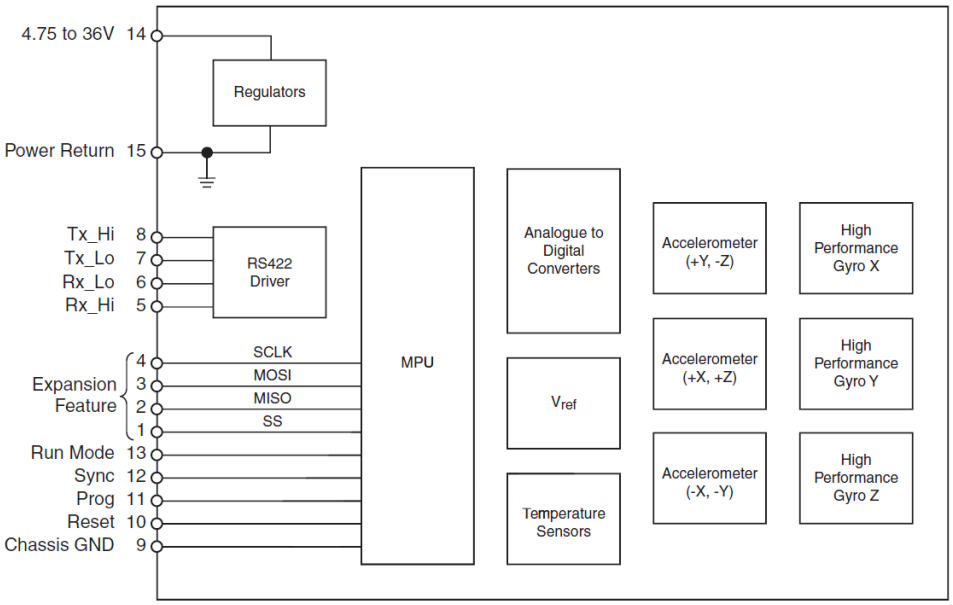


Figure 16: DMU30 Architecture

Table 3 shows the connector pin out for DMU30.

Pin	Signal Name	Signal	In / Out
1-4	Future	A SPI comm port for future expansion	I
5	Rx_Hi+	Serial digital data input - RS-422	I
6	Rx_Lo-	Serial digital data input - RS-422	I
7	Tx_Lo-	Serial digital data output - RS-422	O
8	Tx_Hi+	Serial digital data output - RS-422	O
9	Chassis Ground	Chassis Ground	I
10	RESET	Processor reset (active low)	I
11	Boot0	Programming control pin	I
12	Sync Pulse	Pulse at set sampling point (active high)	O
13	Enable/Disable	Serial Stream control	I
14	Power	+4.75 to +36 V DC power supply	I
15	GND	Power Supply Ground (0V)	I

Table 3: Connector Pin Out

A typical connection to a host system is shown in Figure 17. Note that some connections are not essential for correct operation.

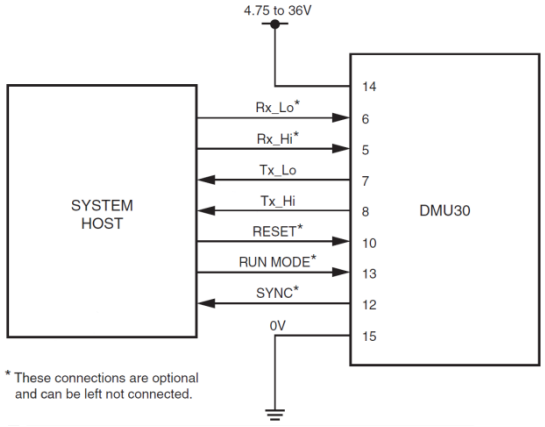


Figure 17: Connection to a Host System

Table 4 describes the format of the data output message for DMU30.

Item	Word	Data Item	Value / Units
0	0	Header	16 Bit, 0x55AA
1	1	Message Count	16 Bit, 0 to 65535 decimal.
2	2-3	Axis X Rate	32 Bit Single Precision FP, (˚/s).
3	4-5	Axis X Acceleration	32 Bit Single Precision FP, (g).
4	6-7	Axis Y Rate	32 Bit Single Precision FP, (˚/s).
5	8-9	Axis Y Acceleration	32 Bit Single Precision FP, (g).
6	10-11	Axis Z Rate	32 Bit Single Precision FP, (˚/s).
7	12-13	Axis Z Acceleration	32 Bit Single Precision FP, (g).
8	14-15	Aux Input Voltage	32 Bit Single Precision FP, (volts).
9	16-17	Average IMU Temperature	32 Bit Single Precision FP, (˚C).
10	18-19	Axis X Delta Theta	32 Bit Single Precision FP, (˚).
11	20-21	Axis X Delta Vel	32 Bit Single Precision FP, (m/s).
12	22-23	Axis Y Delta Theta	32 Bit Single Precision FP, (˚).
13	24-25	Axis Y Delta Vel	32 Bit Single Precision FP, (m/s).
14	26-27	Axis Z Delta Theta	32 Bit Single Precision FP, (˚).
15	28-29	Axis Z Delta Vel	32 Bit Single Precision FP, (m/s).
16	30	Axis X BIT Data	16 Bit, 0 to 65535 decimal.
17	31	Axis Y BIT Data	16 Bit, 0 to 65535 decimal.
18	32	Axis Z BIT Data	16 Bit, 0 to 65535 decimal.
19	33	Checksum	16 Bit 2’s Complement of the 16 Bit Sum of the Previous 0-18 data items.

Table 4: Operational Message Data Output Descriptions

6.1 Sensor Sampling and Synchronisation

When the DMU30 Evaluation Kit is not used, it is possible to make use of the 'Sync Pulse' output from the DMU30.

The Inertial Sensors within DMU30 are all sampled at 1000 Hz. The 'Sync Pulse' on the connector is set HIGH at the start of the sampling and returned to LOW when the last Inertial Sensor is sampled. Pulses are therefore seen on the connector at 1000 Hz.

The Inertial Sensors measurements are then be filtered with a 2nd order low pass filter, also running at 1000 Hz. The factory default setting for this filter is to have a corner frequency of 100 Hz.

The DMU30 message is output at 200 Hz, of every 5th sampling cycle. The sequence is:

- Cycle 1: Sample Sensors, 2nd order Filter.
- Cycle 2: Sample Sensors, 2nd order Filter, Calculate Sensor Compensation.
- Cycle 3: Sample Sensors, 2nd order Filter, Apply Sensor Compensation.
- Cycle 4: Sample Sensors, 2nd order Filter,
- Cycle 5: Sample Sensors, 2nd order Filter, Transmit Message.

The message is transmitted after the 'Sync Pulse' associated with Cycle 5 has returned LOW. The Inertial data included in the message is when the 'Sync Pulse' associated with Cycle 3 was HIGH. This enables the external equipment to synchronise with the time when the Inertial Data was valid.

The Output Message is output on the RS422 Serial output at 460,800 baud using a non-return to zero protocol. Each message contains a start bit (logic 0), 8 data bits and 2 stop bits (logic 1).

7 DMU30 Electrical Connections

The interface cable shown in Figure 18 enables the DMU30 to be connected directly to the MEV interface allowing the application to be used immediately.

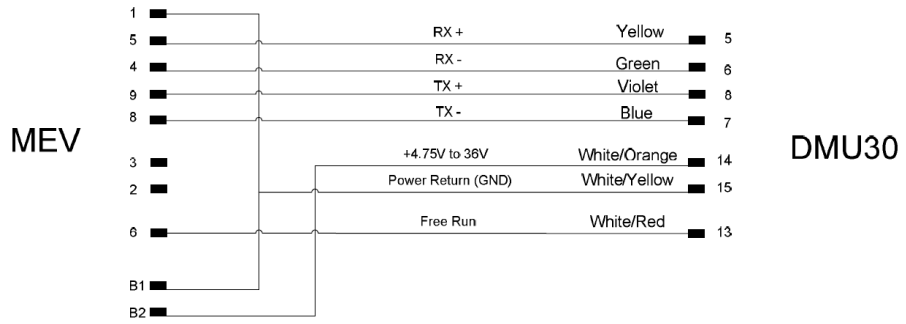


Figure 18: Interface Cable 630567-0940

Should the user wish to connect to the DMU30 to a separate power supply and/or logging software, a 15-way micro D-type connector will need to be purchased (manufacturer part number **MWDM2L-15P-6E5-18**), as it is not included in the evaluation kit. Figure 19 highlights pin numbering of the socket on the DMU30, as seen from above.

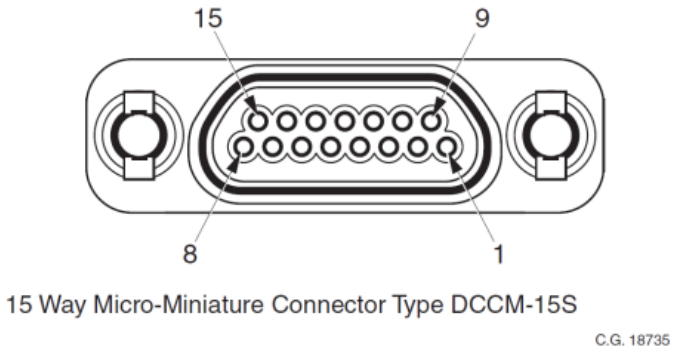


Figure 19: Pin numbering of the DMU30 socket

The interface cable (part number **630567-0940**) has 2 banana plugs coming from it. These should be connected to a power supply. The black banana plug should be connected to the ground terminal of the power supply, whilst the red banana plug to a voltage source ranging between 4.75V DC and 36V DC. Exceeding this range can result in a malfunctioning unit.

8 Installation

The installation drawing for DMU30 is shown in Figure 20.

The DMU30 is designed for 4 point mounting using M5.0 screws. During calibration alignment is achieved using two external reference dowel holes on the base of the DMU30. The dowel holes are designed to be used with two Ø3mm (in accordance with BS EN ISO 8734 or BS EN ISO 2338) dowel pins provided by the host.

.

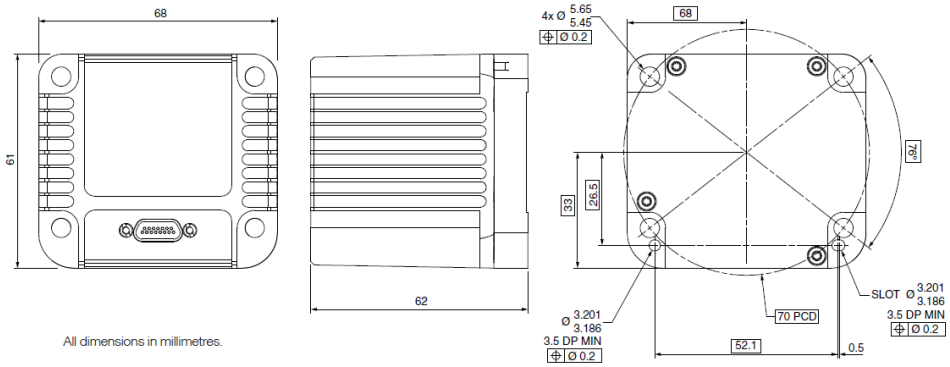


Figure 20: DMU30 Installation

9 Software Updates

If there has been an update to the software supporting the DMU30 Evaluation Kit, it can be downloaded from the 'Software' section of the download library at:

http://www.siliconsensing.com/information-centre/downloads-library/

10 Contact Details

If you require any additional information about the DMU30 Evaluation Kit or any other products please contact Silicon Sensing via:

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